CAMBRIDGE INTERNATIONAL EXAMINATIONS

GCE Ordinary Level

MARK SCHEME for the October/November 2012 series

5054 PHYSICS

5054/21   Paper 2 (Theory), maximum raw mark 75

This mark scheme is published as an aid to teachers and candidates, to indicate the requirements of the examination. It shows the basis on which Examiners were instructed to award marks. It does not indicate the details of the discussions that took place at an Examiners' meeting before marking began, which would have considered the acceptability of alternative answers.

Mark schemes should be read in conjunction with the question paper and the Principal Examiner Report for Teachers.

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Section A

1 (a) 950 N   B1
       upwards   B1

   (b) correct rectangle **and** diagonal **and** at least one velocity labelled
       or correct triangle and at least one velocity labelled
       (either way round)   B1
       from 7.8(0000) to 8.0(0000) m / s (inclusive)   B1
       scale stated   B1   [5]

2 (a) (i) output/voltage/e.m.f. (directly) proportional to temperature (difference)   B1

       (ii) $\dfrac{7.70 - 6.20}{800 - 750}$ **or** 1.5/50 **or** 0.03 **or** 0.6/1.5 **or** 20(°C)   C1
             770 °C   A1

   (b) glass melts/liquid boils/no remote reading (e.g. head in furnace)   B1   [4]

3 (a) (i) (WD =)mgh **or** 54 × 10 × 2.8   C1
             1500/1510/1512 J   A1

       (ii) (P =) WD/t or E/t **or** 1500/3 **or** 1510/3 **or** 1512/3   C1
             500/503/504 W   A1

   (b) any **two** of:
       also lifting board/rope
       heat in motor/wires/cable
       friction with something named e.g. axle/spindle/air   B2

   (c) (i) power supply, motor and ammeter in series
             (**ignore** series voltmeter and other components)   B1
             voltmeter to measure voltage across motor   B1

       (ii) current (reading) × voltage (reading) or VI B1   [9]

4 (a) (m=)ρV **or** 740 × 30 or 22 000/22 200   C1
       25 000/2.5 × 10^4 kg (allow 24 800 from 22 000)   A1

   (b) (a =)F/m or 30 000/25 000   C1
       (−)1.2 m/s^2 A1   [4]

5 (a) (i) clear attempt at measuring more than one wavelength e.g. 6.85/5

  or 1.30 – 1.45 cm   B1

  10.7 – 11.3 cm   B1

  (ii) $(v =)f\lambda$ **or** 3.6 × **(a)(i)**   C1

  40(39.6) cm/s   A1

(b) (i) stays the same   B1

  (ii) decreases   B1   [6]

6 (a) any **three** of:

  infra-red and microwaves reversed

  visible light is omitted

  ultrasound is not e.m./should not be included

  ultraviolet is missing ('ultrasound instead of light' scores 2)   B3

(b) engineering use   M1   detail/explanation   A1

detecting cracks in metal	(more) X-rays pass through crack/poor weld
or	**or**
checking welds	image of crack on film/screen
astronomy	hot stars emit X-rays
crystallography	diffraction reveals pattern of atoms
fluorescence	substances re-emit different energies
(airport/border) security	contents of luggage/lorries revealed
paintings investigated	underpainting revealed

  (**not** medical use)   [5]

7 (a) (at least) **two** parallel horizontal lines within the cylinder   B1

  (at least) **two** correctly shaped lines outside the cylinder   B1

(b) (i) ◄——————— (right to left) **and** on diagram (somewhere)   B1

  (ii) 1. path continuously curving in same direction   M1

    upwards (**ignore** lines outside the shaded area)   A1

  2. (changes to) downwards (curve) **not** reverses/opposite direction   B1   [6]

8 (a) (i) $(V =)IR$ or 0.025×600 C1
           15 V A1

   (ii) 5(V) **or** 5/0.025 **or** 800 **or** 800–600 C1
         200 Ω A1

   (b) (i) decreases B1

   (ii) ammeter: opposite to **(i)**
         voltmeter: same as ammeter (both changes correct) B1 [6]

                                                                [Total: 45]

Section B

9 (a) (i) $(\Delta P=)\rho gh$ **or** $1000 \times 10 \times 120$ C1
           1.2×10^6 Pa A1

   (ii) 1.3×10^6 Pa B1 [3]

   (b) (i) $(F =)PA$ **or** $1.2 \times 10^6 \times 0.45$ **or** $1.3 \times 10^6 \times 0.45$ **or** 5.4×10^5 (N) C1
           $5.8/5.85/5.9 \times 10^5$ N A1

   (ii) any **two** of:
         weight of hatch
         pressure inside submarine
         friction at seal/hinge/water resistance
         lever effect B2 [4]

   (c) (i) sound or pressure wave B1
           frequency > 20 kHz/**frequency** beyond human hearing/inaudible B1

   (ii) (water) molecules/particles vibrate/oscillate B1
         molecules collide with other molecules/neighbours B1
         pass on vibration/energy (to neighbours)
         or longitudinal (vibration/wave) or compressions and rarefactions B1

   (iii) **1.** speed of sound/ultrasound (in water/sea water) B1
          2. speed $\times t \div 2$ B1

   (iv) cleaning/quality control/detecting cracks/prenatal screening/
         kidney stones/detecting shoals of fish/(used by dolphins/bats) B1 [8]

                                                                [Total: 15]

10 (a) 16 × 7.5 **or** 120 **or** 96–17 **or** 79   C1

     ($Q =$)$mc\Delta T$ **or** 120 × 2300 × 79   C1

     2.2(2.1804) × 10^7 J   A1

(b) (i) 2.2 × 10^7/7 **or** 2.2 × 10^7/ (7 × 60) **or** 2.2 × 10^7/ (7 × 3600)   C1

     3.1 × 10^6 J/h **or** 5.2 × 10^4 J/min **or** 870 J/s **or** W   A1

     (ii) (heater/bricks) hot(ter) (**not** room cooler)   B1

     great(er) temperature difference (between heater and room)   B1   [4]

(c) air (next to heater) gets hot **or** conduction through metal/casing   B1

     expands **or** radiation **or** IR (radiation)   B1

     less dense   B1

     rises   B1

     circulation **or** convection current **or** arrows on Fig. 10.2   B1   [5]

(d) double glazing/cavity walls/ceiling

     tiles/carpet/curtains/loft insulation etc.   **or**   shiny foil   B1

     traps air   radiation reflected   M1

     air is poor conductor/convection   IR radiation/

     prevented   back into room   A1   [3]

                                                                [Total: 15]

11 (a) (i) correct negative charges on tree.   B1

     (ii) electrons/-ve charges attracted by cloud/+ve charges   B1

     electrons from ground **or** correct induction mentioned   B1

     (iii) 1. 560/1.6 × 10^{-19} C1

                3.5 × 10^{21} A1

          2. ($I =$)Q/t **or** 560/2 × 10^{-4} C1

                2.8 × 10^6 A   A1   [7]

(b) (i) at least 4 vertical lines between plates   B1

     equally spaced **or** curved at edges   B1

     arrows +ve to –ve/upwards   B1

     (ii) oil droplet positively charged   B1

     attraction/force on (droplet) and in direction of field/upwards   B1

     force greater than weight (of droplet) **or** resultant force   B1

     (iii) (droplet becomes) negative   C1

     (droplet) gains electrons   A1   [8]

                                                                [Total: 15]